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# **SANITATION NEEDS IN ALASKA**

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**ALASKA DEPARTMENT OF HEALTH**

**1949**

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*A Proposed  
Program of Research  
In  
Environmental Sanitation  
In Alaska*



**HAROLD A. WHITTAKER**

Special Consultant, U.S.P.H.S.

Professor, Public Health Engineering.  
School of Public Health, University of Minnesota.

Formerly Director, Division of Sanitation,  
Minnesota Department of Health.



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## FOREWORD

The importance of Alaska to our national economy and national defense has been evidenced by the interest Congress has taken in the Territory. If Alaska is to be developed and populated at the rate desired by national leaders, it is essential that present defects in the field of environmental sanitation be corrected. Adequate planning for housing, water supply, sewage disposal, and other essentials for healthful living must be instituted without delay.

As a part of the effort being directed toward correction of existing defects, the writer spent the months of July and August, 1948, in Alaska for the express purpose of determining, insofar as possible, the acute problems in environmental sanitation in the Territory at the present time. From field observations and from information available in Federal and Territorial departments and agencies, particularly the Alaska Department of Health, the writer sought specific evidence of existing problems in sanitation in need of correction.

The major objective of the two-months study was to select from the list of sanitary problems those which need investigation and research in order to develop a practical solution. Sanitary problems that require such treatment fall logically within two groups, those that require short-term investigations and those that require research which might involve study over a longer period of time. This report presents a review of the problems discovered and outlines suggested research studies which in the opinion of the writer are essential for their solution.

Environmental sanitation, as used in this report, is defined to include public health activities directed toward the control of disease and other ill effects associated with a faulty environment. In health department practice, these activities usually include those undertaken to:

- (a) Protect domestic water supplies,
- (b) Insure the proper disposal of sewage and other waste,
- (c) Prevent the pollution of waters,
- (d) Protect public bathing places,
- (e) Safeguard the production, processing, handling, distribution, and dispensing of foods,
- (f) Provide adequate and safe housing facilities,
- (g) Minimize atmospheric pollution,
- (h) Prevent occupational hazards, and
- (i) Control animals and insects involved in the spread of disease.

It should be explained that during the two months spent in the Territory of Alaska the writer visited many places of particular concern to this report and interviewed over a hundred officials and other persons to obtain information that would be of value.

HAROLD A. WHITTAKER,  
Special Consultant, U.S.P.H.S.



## CONTENTS

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	Page
Foreword .....	4
Sanitation Activities in the Alaska Department of Health .....	6
Sanitary Conditions in Alaska .....	13
Special Problems of Sanitation in the Permafrost Area .....	19
Information on Prevalence of Enteric Infections in Alaska .....	22
Proposed Studies for Investigation and Research in Arctic Sanitation.....	24
Arctic Health Institute .....	26



## SANITATION ACTIVITIES IN THE ALASKA DEPARTMENT OF HEALTH

The Alaska Department of Health is the agency primarily responsible for public health work in the Territory of Alaska. The organization of this Department is described in various publications and will not be repeated in detail here. In brief, the present organization includes the eight following named divisions and units that are responsible to the Commissioner of Health:

- Division of Sanitation and Engineering
- Division of Public Health Laboratories
- Division of Communicable and Preventable Disease Control, including Tuberculosis Control
- Division of Maternal and Child Health and Crippled Children's Services
- Division of Public Health Nursing
- Health Education Unit
- Medical Social Service Unit
- Mobile Health Units

The Division of Sanitation and Engineering is responsible for the activities of the Department in environmental sanitation, which include education, inspection, consultation and enforcement services on sanitation activities in the following fields:

1. Water supply
2. Sewage disposal
3. Food handling
4. Milk supply
4. Salmon, clam, crab, and shrimp processing
6. Practice of cosmetology and barbering
7. Operation of hotels and rooming houses
8. Garbage collection and disposal
9. Housing
10. Swimming pool and bathing beach construction and operation
11. Interstate carrier watering points
12. Bottled waters and beverages
13. Water pollution
14. Plumbing
15. Heating, lighting and ventilation of dormitories, schools and public buildings
16. Rodent control
17. Industrial hygiene
18. Property and public health nuisances; requests for advice from private individuals; and requests for advice from local health officials.

In addition to the above-named activities, the Division of Sanitation and Engineering cooperates with the Federal departments and agencies that function in the Territory and particularly with those that have installations



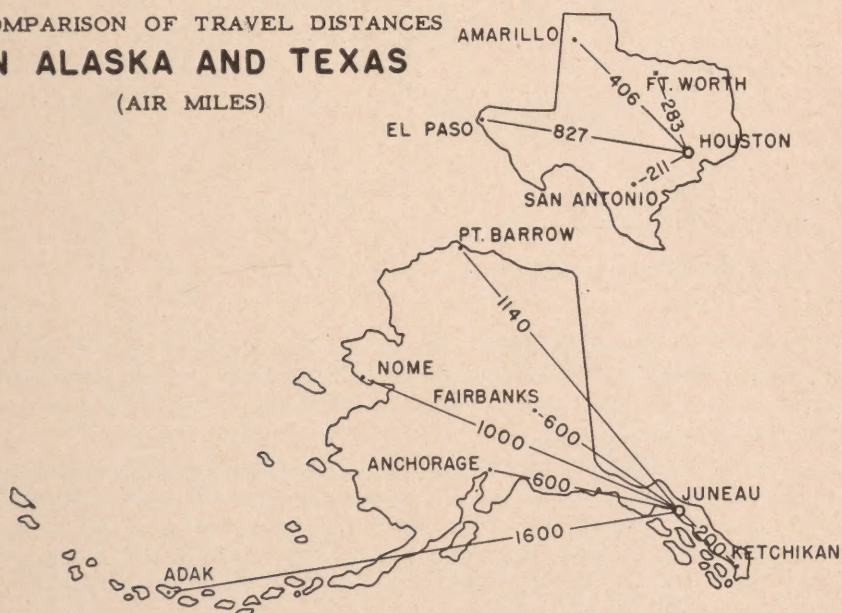
scattered throughout the area which have sanitary problems of mutual concern. Some of the principal departments and agencies involved are the Department of the Interior, Department of Commerce, Department of National Defense, Department of Agriculture, and the Federal Works Agency. Examples of such installations are public buildings, schools, hospitals, stations (weather, aeronautical), housing for employees, camps, parks, military camps, and other establishments.

Standard practices are used in conducting routine field investigations, plant inspections and laboratory examinations related to the activities of the Division of Sanitation and Engineering,

Many difficulties are experienced in carrying out a program in environmental sanitation in Alaska, especially when the necessary activities are conducted largely from one central office. The civilian population of 94,000 people (1947 estimate) and a large number of seasonal workers and military personnel are scattered over an area of 586,400 square miles, with great distances and many physical barriers, such as mountains and water, separating many sections or parts of the Territory from any single point of operation. For example, the distance from Juneau to Attu Island is roughly 2,200 air miles, and the distance from Juneau to Point Barrow is approximately 1,100 air miles. Transportation is limited practically to air travel. In fact, only about once a year do supply ships reach Barrow and the Arctic Coast ports to deliver heavy freight and supplies.

Transportation of samples of water, milk, food, sewage, and so forth, from most points in Alaska to a central laboratory is not dependable because of the time element involved in shipment and the difficulty of samples freezing during low temperature periods that exist in certain areas much of the time.

#### A COMPARISON OF TRAVEL DISTANCES IN ALASKA AND TEXAS (AIR MILES)





Reaching isolated points by air also necessitates special plane service, which is expensive and difficult to schedule. Much time is lost in waiting for planes cancelled because of weather conditions.

Without going into further discussion of these obvious difficulties, it becomes apparent that if the present program of environmental sanitation is to progress, a plan for local health services, adapted to Alaskan conditions, must be further developed and put into operation.

In addition to the difficulties already mentioned, the Division of Sanitation and Engineering has had extremely limited funds for use in carrying on the sanitation program. Territorial funds have rarely exceeded \$8,000 per year and this amount, with matching funds from the Public Health Service Grants-in-Aid Program, answers only a small part of the needs in administering a program in an area one-fifth as large as the entire Continental United States. The Division was organized in 1937, and until 1946, it rarely had more than one or two persons working on the program. Many improvements in sanitation have been made in spite of the numerous handicaps, and the sanitation program has made an excellent return on the small



The Territory of Alaska is equal in size to one-fifth the total area of the continental United States. Within its boundaries, Alaska embraces extremes of climate, topography and health problems as varied as those found in the different sections of the United States.

Because of its vast size, its large number of small isolated communities, its peculiar terrain and weather conditions, the development of an adequate sanitation program for Alaska necessitates an above-average ratio of sanitation personnel to population; decentralization of supervisory headquarters; increased travel budgets; and modification of accepted methods of sanitation and public health engineering to fit Alaska's needs.



investment. It should also be pointed out that the Division has not had adequate funds with which to undertake research on the many unsolved sanitary problems of the Territory.

The following information, relating to the activities listed, was obtained largely from the official records of the Division of Sanitation and Engineering of the Alaska Department of Health.

**Water Supplies:** There are 174 public water supplies recorded with the Alaska Department of Health. A public supply is defined as one that supplies 25 or more people with water. It would appear from the records available in the Department that of this number, at least eighty per cent are in need of improvement to insure reasonable safety. There are numerous other semi-public supplies which include supplies for schools, camps, resorts, and institutions. Many of these are believed to be unprotected and generally unsafe. In addition, it is estimated that there are 15,000 to 20,000 water supplies for private homes, many of which need improvement.

An annual inspection is made on bottled water and beverage plants, of which there are about twelve in the Territory. Much water is distributed in permafrost areas from tank trucks in bottles and buckets as a regular source of drinking water because of the difficulty of obtaining water from other sources.

The routine certification of 29 watering points from which water is supplied to interstate carriers is undertaken each year for the Public Health Service.

**Sewage and Industrial Waste Disposal:** There are about 315 towns and villages in the Territory that should have sewerage systems, but only 13 of these places are now provided with these facilities. Of the 315 communities, 174 are located in the permafrost areas where conventional waste disposal methods used in the States are inapplicable. Of the 13 places having systems, all discharge the sewage into tidal estuaries and rivers without treatment. Two of these systems were provided originally with sewage treatment plants consisting of plain settling tanks, but neither of them is functioning at the present time because of the high costs of operation. It is estimated by the Department that there are at least 20,000 private premises without a satisfactory means of waste disposal.

The important industrial waste disposal problem in the Territory concerns the 158 fish canning plants scattered along the coastal areas of Alaska. This industry cans salmon, halibut, red snapper, herring, crabs, clams, shrimp, and oysters. These canneries are reported to produce about one-third of the world's supply of salmon. The plants are located along the beaches, usually constructed on piling extending partially over tidal waters. According to common practice, the canning wastes from these plants, consisting of the heads, entrails, fins, tails, sometimes the skins of the fish, and also the washings from plant equipment and floors, and the sewage from toilet and lavatory fixtures, are usually discharged directly onto the beach under or near the plant, to be removed by tide water. However, during



the intervals when the tide is out, wastes are exposed on the beach, and when the tide returns the partially decomposed waste floats about on the surface of the water and some of it is inevitably deposited on the shore and on the beach as the tide recedes. These deposits along the shore and on the beach do create a nuisance in some localities and also provide food for rats that infest many of the communities where such plants are located.

The waste from a few canneries is taken to reduction plants for the manufacture of by-products, which reduces the possibility of pollution at these places.

**Cosmetology and Barbering:** The sanitary inspection of barber and beauty shops is done routinely to prevent the spread of transmissible disease through improperly sterilized combs, brushes, razors, and other utensils. There are approximately 120 of these places operating, and an effort is made to cover them about once a year.

**Food Handling:** It is estimated by the Department that there are approximately 1,000 eating and drinking establishments in the Territory that should have regular inspections in order to maintain reasonable standards of safety. With present facilities and staff, it has not been possible to make more than 2,000 of the minimum of 6,000 inspections that should be made on these places each year. It is estimated that about eighty per cent of these eating and drinking establishments do not fully comply with recognized standards for such establishments.

While traveling about the Territory, particular attention was paid to the sanitation of eating places, and with the exception of a few places where some supervision has been possible, restaurant sanitation was at a relatively low level when compared with recognized standards for eating establishments.

It appears that intestinal disturbances are common among certain groups of the native population of Alaska, and some of this difficulty may be caused by unsanitary methods, customs, and practices. It might be unwise, however, to change present practices without knowing whether it will improve the situation from both a sanitary and nutritional point of view. A study of native food handling methods, customs, and practices, combined with a study of the nutritional aspects, should provide information that would be helpful to the health program at this time.

**Milk Supplies and Dairy Products:** A limited amount of the milk sold in Alaska is produced in the Territory. There are only about sixty farms and plants producing fluid milk. Most of these producers operate dairy farms having 15 to 100 head of dairy cattle. The balance of the milk consumed is frozen, powdered, or evaporated milk shipped from the United States and Canada.

It is estimated that about ninety per cent of the fluid milk supply is pasteurized. More progress has been made in milk sanitation than in most of the other activities because of the limited number of dairies and their



accessibility to inspection services. There are about thirty frozen dessert manufacturing establishments that also require inspection. There are also about 1,000 meat markets, groceries, and bakeries that are included in the food sanitation program.

**Salmon, Clam, Crab and Shrimp Processing:** Fish canning is one of the most important industries in Alaska at the present time. There are about 200 plants processing sea foods in the Territory. A large part of the clam, crab and shrimp products is frozen packed, which requires more rigid control than a cooked product such as salmon. One of the well known health hazards associated with shellfish is paralytic shellfish poisoning, caused by *Gonyaulax catenella*. Adequate control of this problem should include inspections of the beaches from which the clams are harvested. The size of the inspecting job will be appreciated when it is realized that the beaches from which the shellfish, particularly clams, are obtained at the present time extend over about 6,000 miles, or approximately one-fourth of the entire coast of Alaska.

**Hotels, Rooming Houses, Camps and Resorts:** The Department does not have an accurate record of the number of hotels and rooming houses, but estimates conservatively that about one hundred are operating in the Territory. This activity is handled only on the receipt of a complaint; therefore, no accurate recording of such places has been made.

The records show the following number of camps and resorts: Cabin camps, 12; trailer camps, 20; logging camps, 15; mining camps, 30; roadside lodges 53; youth camps, 16; recreational areas, 31.

With the influx of people into Alaska, especially for defense work, for employment in industry, and as tourists and settlers, there is a real need for sanitary supervision of these places.

**Garbage Collection and Disposal:** Of the 315 towns and villages, only 15 have an organized community garbage collection service, in which the usual method of disposal is by dumping and burning at the garbage dump. However, in the coastal areas, these dumps are usually placed on the beaches, in the expectation that the tide will remove the garbage, but only in a very few cases does this actually occur to any considerable degree. In the permafrost area, which involves 174 of these communities, low-temperature conditions prevent disposal of garbage by burial for a great part of the year. Under these conditions the land-fill method does not seem to be practical, and investigation is essential to determine whether it can be adapted to low-temperature areas.

**Housing:** The Alaska Department of Health has surveyed housing in various parts of Alaska and has concluded that at least fifty per cent of all housing in the Territory is sub-standard. The survey further revealed many deplorable conditions as represented by dilapidated dwelling structures and a congestion of occupants that present decided health hazards.





The extreme isolation of many Alaskan communities and their inaccessibility to existing highways make the use of both airplanes and dog sleds essential in carrying out the various programs of the Alaska Department of Health. Further transportation difficulties occur during the spring break-up when neither dog teams nor airplanes can reach certain areas for a period of several weeks.

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**Swimming Pools and Bathing Beaches:** The principal population centers of the Territory have swimming pool or bathing beach facilities that are used during the short summer period. The Department gives assistance in the supervision of these facilities as far as practicable.

**Water Pollution:** Water pollution surveys have not been undertaken by the Department because of the lack of personnel and facilities to undertake such work. The principal waste disposal problem is that associated with the wastes from fish canning plants. Attention should also be given to the disposal of paper mill wastes as this industry develops.

With the development of the interior portion of Alaska, the ability of waters to receive treated or partially-treated sewage and wastes, under low-temperature conditions, should be studied. This is of particular concern where such waters are used as sources of water supply.



**Plumbing, Heating, Lighting and Ventilation:** These are routine items that are checked on all structures and installations coming under the jurisdiction of the Department.

**Rodent Control:** Rat surveys have been made in ten of the principal communities in the Territory which reveal a widespread infestation from a moderate to a heavy degree. The heavy infestations were associated with low-quality housing and unsatisfactory garbage and waste disposal. These surveys did not show the species and prevalence of rats or their public health significance. Surveys should be made with the view of answering these important questions from a public health standpoint. It should be pointed out in this connection that there is considerable shipping between Alaska and foreign ports where plague and other rodent-borne diseases are known to exist.

**Industrial Hygiene:** In 1946 a survey was made by the Department, in conjunction with the U. S. Public Health Service, of typical industrial establishments in the Territory. As a result of this survey it was estimated that three-fourths of the persons employed in Alaska are working where industrial health hazards exist.

### **SANITARY CONDITIONS IN ALASKA**

A large amount of information on insanitary conditions in Alaska is already recorded in official documents; however, a few specific situations are discussed here in order to show that such conditions continue to exist in the Territory.

Existing housing conditions are most unsatisfactory, as demonstrated by surveys of the Alaska Department of Health, and as observed by the writer in the communities visited. Even the larger cities, including Anchorage, Fairbanks, Juneau, and Ketchikan, have very critical areas.

**Anchorage and Fairbanks:** Anchorage and Fairbanks are cities located near military establishments, Fort Richardson and Ladd Field, respectively. Largely as a result of defense activities, the civil population of Anchorage has increased more than 500 percent during the past ten years, and that of Fairbanks has increased almost three hundred per cent in the same period. This rapid expansion has driven people to seek every available space in which to live. There has also been an expansion in both cities far beyond their corporate limits, where trailer camps, small shacks, and houses have been hurriedly constructed, and where public water supply and sewage disposal facilities are not generally available. This situation has brought about the installation of unprotected private wells, cesspools, and privies on many small lots, thus creating hazardous health situations.

Naturally, much overcrowding exists as a sequel to the housing shortage, and the health menace of such close contact in living quarters is obvious.

It may be of interest to relate that in Anchorage there are 204 public housing units, of which 54 are available for persons not government-



# Sanitation Problems In



Sewer outfall at Cordova,  
typical of many, discharges  
sewage above low tide mark.

Home  
on  
piling,  
Juneau.  
Note  
easy  
waste  
disposal.



Open well dip-bucket style,  
numerous throughout  
Alaska.

This one is located  
on outskirts of Anchorage,  
Alaska's largest city.





# Alaska

Citizens  
of  
Nome  
get  
their  
water  
by  
truck.



Housing in Anchorage includes everything from \$35,000 homes (upper right) to trailer shacks with privies.

Alaska's billion dollar industry—fish canneries—constitute large item in food sanitation program.



employed. With the present turn-over of occupants, it is estimated that it would take a person currently applying for one of these units nineteen years to obtain one.\*

Lack of provision for city planning is probably responsible for part of the present situation, but such planning would not have controlled some of the factors involved in the unusual increase in population. Rapid expansion has placed an extra burden on the public water supply and sewage disposal facilities in Anchorage, adding to the seriousness of the overall sanitation situation since it involves the largest city in the Territory.

Anchorage obtains its water from Ship Creek, near the mouth of the Creek. The intake works consist of a bar screen located about eight or ten blocks from the central part of the city. The only treatment provided is chlorination; no stand-by chlorinating equipment is provided. Frequently the water is unpalatable and contains much suspended material. The Army post, part of the city, the railroad yards, and a refuse dump are all located on the watershed immediately above the intake works. The safety of this water supply is vital because it is available to the local civil population and also to military personnel who visit the city. In addition, international air travel through Anchorage provides some contact with people outside Alaska.

The Alaska Housing Authority has studied the housing situation in the Territory and has pointed out that the housing shortage is extremely critical. There is no doubt that the housing situation is seriously affecting the development of the Territory. People, especially those with families, hesitate to come to Alaska because there is no place to live; or if they do come, they must move into congested quarters and sometime slum dwellings without sanitary facilities. Of the many programs planned, housing should have a high priority.

**Juneau and Ketchikan:** Another example of the sanitation problem exists at Juneau and Ketchikan. These are coastal cities with mountains rising sharply to an elevation of several thousand feet, leaving only a narrow talus slope as a site for a community. In both cases, most of the buildings along the shore are built on piles; in fact at Ketchikan the buildings and streets resting on pile construction extend several blocks out over tidal flats.

The sewage from private places and waste from industries in both cities is discharged onto these flats at the most convenient point. In fact, toilets located in plants and in private homes over these tidal flats discharge directly onto them. When the tide is out deposits of feces and other wastes, including some garbage, are visible under the buildings. As the tide comes in, some of the material is picked up by the water, and as the tide recedes, only a part of this mass of partially-decomposed waste is removed.

In Juneau a large number of shacks and small homes along the waterfront are built on piles. Occupants of these homes dump their wastes, including some garbage, onto land-locked tidal flats under their homes.

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\* By Mr. E. G. Wilder, Director of the Alaska Housing Authority.



These situations in regard to waste disposal, which have been described, create a public nuisance at times, furnish food for rats that infest these cities, and are most insanitary.

The sewage collecting systems of these cities also present some sanitary problems. Very steep grades lead to some of the homes located on the mountainsides, and trouble is experienced in the proper construction and maintenance of sewers.

**Klawock and Barrow:** A visit was made to several native villages to observe sanitary conditions. Two of the villages observed were the Indian village of Klawock on Prince of Wales Island and the Eskimo village of Barrow near Point Barrow on the Arctic Ocean. While not necessarily representative of all villages, the observations will serve to illustrate some of the sanitary problems at these places.

Klawock is a village with a population of about 500 people. It has a small public water supply obtained from a surface stream, and the water is not treated. The village has no public sewage system. Garbage is disposed of by throwing it from the dock, to be carried away by tide water. This practice is unsatisfactory. There are two fish canning factories in the village and one small sawmill. The canneries afforded some work for the

**SANITARY STATUS OF CERTAIN ALASKAN**

**FACILITIES AND SERVICES**

JULY 1, 1948



Each row of symbols in the above chart is representative of a service or facility, the sanitary supervision of which lies within the jurisdiction of the Division of Sanitation and Engineering, Alaska Department of Health. This chart has been prepared to show the actual percentage of existing services or facilities, rated according to the minimum standards of the United States Public Health Service, which can be classed as "acceptable". The proportion of "acceptable" services is indicated by the number of uncanceled symbols in each row. Particular attention is called to the high percentage of waste disposal systems and water supplies in Alaska which fail to meet established minimum standards.



natives when built, but now much of the labor is obtained from outside sources. Sewage and canning wastes from the canneries are discharged onto the beach or into the water under the canneries, and are not satisfactorily removed by tide water.

A public school and several stores are located in Klawock. There are a few reasonably well-built homes, but many of the native dwellings are old dilapidated buildings. Some of the homes do not have toilets of any sort, and apparently the excreta and liquid household wastes are thrown out onto the ground. Sanitary conditions in the native section known as "The Island," which includes the homes just described, are particularly bad. It is reported that the children of the village suffer a great deal from respiratory infections.

Barrow is a native Eskimo village with a population of about 700 people. The area is underlaid with hundreds of feet of permanently frozen ground. There are a school and a hospital operated by the Alaska Native Service. The native section of the village includes about 100 homes, most of them built of driftwood or scraps of lumber, pieces of canvas, and so forth; a few are constructed of regular lumber, and some are sod houses. Considerable interest has been displayed by the natives in building frame houses, especially in the last few years since employment has been available for the natives through the contract office of Naval Petroleum Reserve No. 4 at Point Barrow. Barrow is more fortunate economically than most native villages because of this employment. The homes in the village are heated with coal obtained from a mine about eighty miles from the village, which is operated under the supervision of the Alaska Native Service.

The water supply for the hospital and the school is obtained from melted ice from a fresh water lake in the winter. During the summer, water is hauled from the lake. The ice is melted in tanks provided with steam coils, and no treatment of the water is provided. The ice is melted in the Eskimo homes by placing it in a kettle or can on the stove.

Perishable foods such as fish and meats are stored in pits or shafts in the permanently frozen ground.

Empty fifty-gallon oil drums are placed around the village at convenient points for collection of excreta and liquid wastes. Each family is expected to provide its own pail or receptacle for the collection of waste, including feces and urine. In winter the contents of the drums freeze immediately, and when filled the drums are taken out on the frozen Arctic Ocean in front of the village, to float away during the warm weather season. During the short summer periods, the drums are hauled to the garbage dump and disposed of with the garbage. While these waste disposal practices, as they are operated, are far from being satisfactory, nonetheless they are an improvement over throwing wastes on the ground around the home, which is a common practice in many villages.

Housing is no doubt the most critical sanitary problem in Barrow. There are about 100 native houses for some 700 people. When a family is large,



terrific crowding results in the small houses. For example, in one case thirteen people live in a shack nine by twelve feet in dimension; in another case, eleven people were living in an eight by ten-foot hut. The cost of housing in some of the villages is far beyond the income of the natives. There appears to be a definite need for studies to develop designs and local materials which can be used by the natives in constructing their homes.

As in Klawock, respiratory infections are said to be very common in Barrow, and the school has closed from one to three times a year during the past five years because of colds. Intestinal disturbances are also very common in the village. The cause is not definitely known, but since many of the disturbances occur after eating certain native foods, it is believed that in some cases food is involved.

The problem of improving sanitation in native villages is a difficult one, hampered in most cases by the economic status of the natives, and to some extent by the habits and customs of the people.

### **SPECIAL PROBLEMS OF SANITATION IN THE PERMAFROST AREA**

Climatic conditions, especially in low-temperature areas, seriously affect the problems of housing, water supply, and sewage and waste disposal. These conditions create problems that require methods of treatment which differ considerably from those used in other parts of the United States. The greatest difficulty occurs in the so-called permafrost region, which is estimated to cover sixty per cent, or 370,000 square miles, of the total area of the Territory and, roughly speaking, is the area situated north of the 30° F. isotherm. (See map, following.) In this region the ground remains frozen throughout the entire year for depths ranging from a few feet to great depths, except for vertical sections at or near the ground surface, where the ice in the earth formation thaws to a depth varying from a few inches to a number of feet during the summer season. This situation makes the construction of buildings in permafrost areas difficult because of soil instability and differential heaving caused by disturbances of the normal thermal regime.

Water supplies also become a serious problem in permafrost areas, especially in locating suitable sources and obtaining ground water from wells where the frost extends to any considerable depth. Serious difficulty is experienced in drilling through permafrost, since the temperature is constantly below freezing and any liquid in a drill hole or well excavation freezes almost immediately unless heated with steam or some other means. The drilling of wells in such earth formation is naturally followed by operating difficulties as the water may freeze in the well casing. Under these circumstances, the use of ground water in many sections of the permafrost area is not feasible.

Low temperature conditions also affect surface water supplies in that many shallow fresh water lakes freeze to the bottom, and the deeper lakes

may freeze to a depth of six to eight feet, depending on snow coverage and other factors. The freezing process under such conditions tends to concentrate, in the unfrozen water under the ice, a large part of the inorganic salts and organic material present in the lake water before freezing. This concentrated mass of suspended and dissolved material in the lake water may make it unfit for domestic use and dangerous to health. It should also be added that the task of cutting through six to eight feet of ice to reach the water is a difficult one without special equipment such as a steam jet.

Because of the situations just described, it is frequently necessary to resort to the use of melted ice or snow as a source of water.

Another problem associated with water supplies in low temperature areas is the design, construction and operation of water purification plants. In addition to protection against freezing, there are troubles associated with chemical and biological treatment processes with water practically at the freezing point. The design of water treatment plants is also made difficult by the lack of information on the chemical, physical, and biological characteristics of surface waters throughout the Territory. Studies to obtain this information on important inland streams and lakes should begin as soon as possible.

No doubt one of the most vexing problems associated with water supply installations equipped with a distribution system in permafrost areas is that of developing an economical design that will prevent freezing in the distribution mains and service connections. Two of the devices commonly used for this purpose require that the water pipes be enclosed in an insulated, heated conduit located either above or below the ground surface; or



About 60% of Alaska is underlaid by permanently frozen ground (permafrost). In the most northerly sections this permafrost often extends to a depth of several hundred feet.



that the water be heated at the source and sometimes at critical points in the distribution system. The latter system usually provides for recirculation of the unused water. Either of these practices is expensive both to construct and to operate and is usually beyond the financial reach of communities requiring such services. This is especially true where the water supply system is accompanied, as it should be, by a sewerage system that, under low temperature conditions, is also expensive to construct and operate.

The construction and operation of sewerage systems, including sewage treatment plants in permafrost areas, is also a difficult and expensive venture. Again, as in the case of the distribution system of a water supply, freezing in the collecting system of sewers must be prevented. The sewage, however, does have one advantage in that most domestic sewage carries some heat when discharged into the collecting system, which helps to prevent freezing. However, if a sewer carrying warm sewage is laid in permafrost, the ice in the area immediately around it thaws and may disturb the alignments of the sewer under these conditions. Therefore, in addition to following the recognized sewer design characteristics, it appears that sewers in permafrost should be thoroughly insulated from the frozen earth, or be placed in a conduit above the ground surface. One practice is to place the sewers and the water mains in a single insulated conduit or box, thus utilizing some of the available heat in the sewage to heat the conduit, with additional heat provided by means of a steam line. This type of construction, enclosing the water and sewer pipes and sometimes other services such as telephone and electrical wires, has been called a "utilidor."

Obviously, the cost of such a combined system of pipes for water supply and sewer system for the average community is prohibitive. Furthermore, the placing of the water and sewer pipes in the same conduit creates a sanitary hazard. Should the sewer pipe leak and discharge sewage into the "utilidor" at a time when there was a leak in the water pipe, especially during a period of negative pressure in the water system, serious contamination of the water system might occur. Designs should be developed to eliminate this health hazard.

There is a real need for careful investigation directed toward solving the serious problem of water distribution systems and sewage collection systems in permafrost regions at a reasonable cost and with greater safety from a public health point of view. Very little information is available on the design and operation of community sewage treatment plants under prolonged low temperature conditions. Investigations should include various methods that appear adaptable to Alaskan conditions. Studies of sewage disposal problems should also consider the recovery of surface waters after receiving sewage pollution, including waters with and without ice covering.

Another matter of serious concern, especially in the southern portion of the permafrost region, is the small private water supply and sewage disposal installation, particularly for the single dwelling. In many cases the water supply of the residence is obtained from a shallow well located on a

small lot, and the sewage from the house is discharged into a cesspool on the same property. Such a situation exists at many dwellings in Fairbanks, Alaska.

There seems to be little, if any, information on the movement of pollution underground in such an installation during the summer season when the ground is thawed for some distance below the surface. Another question is how to design and operate a small sewage treatment plant, and again information is badly needed concerning such facilities for the single dwelling. It is also of vital importance to determine whether the effluent of such plants can be safely disposed of underground in permafrost areas. In the event that a small water carriage residential system is found to be an unsafe installation under the conditions described above, what other means of disposal can be used?

Chemical toilets have been used in some cases where a water carriage system could not be operated, and studies should be made to develop a satisfactory method for handling and disposing of the toilet can contents. Pit privies are difficult to construct in frozen ground, and, if it is found that such installations can safely be used in permafrost areas, easier methods should be developed for pit construction in frozen ground. It is also questionable whether pit privies will be used, unless heated, if constructed where very low temperatures exist.

The preceding discussions on permafrost in relation to housing, water supplies, and sewage and waste disposal are by no means complete, but they may serve to demonstrate the need for further investigation and research on sanitary problems in permafrost areas.

### INFORMATION ON PREVALENCE OF ENTERIC INFECTIONS IN ALASKA

The following statement on enteric infections was prepared by Mr. Ralph B. Williams, Director of the Division of Public Health Laboratories, Alaska Department of Health.

Reports of gastro-enteric diseases associated with high fever, marked diarrhea and dysentery, have been received by the Alaska Department of Health from time to time during the past twenty years. These reports have originated in all parts of the Territory.

From a laboratory point of view very little is known concerning the origin of these outbreaks. Attempts to secure diagnostic stool specimens from patients involved in these outbreaks have failed in most instances, but during the biennium of 1944-46 a total of 338 stool or urine specimens were received. Of this number, it was possible in 41 instances to isolate bacteria of the tribes of the family Enterobacteriaceae. Notable among these isolations were strains of *Salmonella montevideo* and *Salmonella typhimurium*, both associated with food-poisoning outbreaks. Two strains of *Shigella paradysenteriae*, one Flexner Y and the other Boyd 103A, were isolated during a dysentery outbreak on the Kenai Peninsula. Typical strains of *Salmonella typhosa* were among those isolated. At this time another out-



break of dysentery was reported in which four individuals were said to have died with this disease. No specimens were received, however, and only one mortality was reported through official channels. This is the rule rather than the exception.

Communicable disease morbidity and mortality reporting in Alaska is poor. There are a number of reasons for this situation. The first and most important is the lack of adequate medical facilities in a large portion of the Territory. At the present time there are fifty-five licensed physicians practicing in Alaska. With few exceptions, their activities are limited to the larger towns such as Fairbanks, Nome, Anchorage, Seward, Kodiak, Valdez, Skagway, Sitka, Juneau, Petersburg, Wrangell, and Ketchikan. The smaller villages such as Hydaburg, Dillingham, and Nenana, have public health nurses and Alaska Native Service nurses on whom the duties of diagnosis and morbidity and mortality reporting falls. In the isolated or primitive areas these duties are assumed, out of necessity, by one of several individuals, such as the U. S. Commissioner, government school teacher, trader, or some member of the village council. Reports from this latter group are usually in the form of mortality reports with the diagnosis made after death. Tuberculosis is the most familiar cause of death, and therefore is frequently reported as the cause if murder, suicide, alcohol, or forms of accidental death are not indicated.

The Alaska Department of Health has received communications indicating outbreaks of enteric diseases, but in many instances not a single morbidity report is received following the reported epidemic. The information regarding these outbreaks is usually greatly delayed and is received at a time when epidemiological investigations are out of the question. Since authentic records are not kept for the vast unsettled North Country, an investigation is an impossible task with present facilities. Similarly, the exact nature of the scattered outbreaks reported during the last ten to twenty years must remain unsolved.

In some areas symptoms of enteric diseases are so common that frequent and watery stools after the spring break-up or within a few days after arrival in a given area are taken as a matter of course. Water, food, and climatic conditions are generally blamed. The common nature of the condition has created an attitude of "there is no sickness here—everyone has that."

The Bering and Arctic Coasts of Alaska lack highways and other facilities of modern civilization. In many of the villages the people live under the same conditions as did their ancestors a thousand years ago. A few families have privies, but the majority deposit their body wastes just outside their igloos. During the winter months they do not venture very far from these sod and driftwood homes. At this season the many dogs about gulp down such material as soon as it is excreted. During the summer the wastes may be deposited on the beaches to be carried away in the salt water. The younger children wander about in summer (continuous daylight) like animals, sleeping when tired and wherever they may be, eating

birds and eggs when they find them, and at the same time disposing of their body wastes wherever and whenever the urge arises. In short, unsanitary conditions are the rule.

Reports from school teachers, traders, and others, frequently refer to dysentery and diarrheal diseases. At present there are only three physicians in the area in question and they confine their activities to Bethel, Nome, and Kotzebue. In the summer of 1947, seven deaths among children less than a year of age were reported from Kotzebue. All had fever and diarrheal conditions. No specimens reached the laboratories at Anchorage, Juneau, or Ketchikan.

## **PROPOSED STUDIES FOR INVESTIGATION AND RESEARCH IN ARCTIC SANITATION**

Studies are recommended on the following sanitation problems:

### **1. Housing:**

(a) Studies on economical designs and construction materials, especially for dwellings and housing units, including native housing. In this connection the possibilities of developing and using native or local materials should be considered for possible reduction in cost.

(b) Studies on permafrost problems in relation to construction of housing.

(c) Studies on community planning in order to insure adequate and safe sanitary facilities such as water supply and sewerage systems, garbage and waste disposal.

### **2. Water Supplies:**

(a) Studies on surface waters, which should include the biological, physical, and chemical characteristics of such water. A special study is suggested to determine whether deleterious substances are present in the concentrates which result from the freezing processes and whether these substances remain in the water of lakes under the thick ice coverage that occurs in Arctic regions. Another special study is suggested to determine any characteristics of surface water that might be involved in outbreaks of intestinal disturbances.

(b) Water pollution studies on inland and coastal waters to obtain basic information for water pollution control. These observations should be coordinated with the overall studies on the characteristics of surface waters.

(c) Studies on ground waters, which should include their biological, physical, and chemical characteristics. A special study should be made on the movement of underground waters in permafrost areas, especially in an area where summer thawing extends some distance below the ground surface.

(d) Studies on the design, construction, and operation of wells, water purification plants, and distribution systems for use in low-temperature conditions, especially in permafrost.



### **3. Sewage and Waste Disposal:**

(a) Studies on the design, construction, and operation of sewerage systems, including the collecting system, treatment plant, and outfall sewers for use under low-temperature conditions, especially in permafrost areas. These studies should include systems for communities, institutions of all kinds, and for isolated dwellings.

(b) Studies on methods other than a water carriage system of sewage and excreta disposal under low-temperature conditions. These studies should naturally include such methods as the chemical toilet and the pit privy. In addition to the design, construction, and operation of such installations, their practicability for actual use under low-temperature conditions should be considered.

(c) Studies on fish canning waste disposal, which should include plant investigations to reduce the quantity of the waste, the manufacture of by-products from the waste, and methods of treatment and disposal of the waste.

### **3. Food Handling:**

Studies on native food handling customs and practices in Alaska and their relationship to disease. This study should attempt to develop, as far as possible, remedial practices that may gain acceptance by the natives. This study might well be correlated with an investigation on the nutritional aspects of food.

### **5. Shellfish Poisoning:**

Further studies on shellfish poisoning, including its public health implications and methods of control that may be applied to the production, processing, handling, and distribution of such products.

### **6. Rodent Control:**

Studies on the species and prevalence of rats and their public health significance in Alaska. Not only is this study desirable in establishing the public health implications of rat control, but also to determine the public health emphasis to be placed on this activity.

### **7. Garbage Disposal:**

Studies should be made on the "sanitary fill" method of garbage and waste disposal in low-temperature areas. Special consideration should be given to the rate of disintegration and decomposition of organic materials under such conditions, and also to the feasibility of stock-piling garbage during low-temperature periods. This study might be coordinated with ground temperature observations made in connection with other studies in permafrost areas.

### **8. Insect Control:**

(a) Studies on species, flight range, breeding habits, et cetera, of mosquitoes with the view of determining control methods applicable to Alaska.



(b) Studies with the same objective should be considered in regard to various species of flies that also constitute a serious menace during certain seasons of the year.

#### **9. Clothing:**

Studies on civilian clothing, including footwear, especially designed for practical use in Alaska. Clothing is a matter of serious concern to those who live in low-temperature areas. On several occasions during this visit, persons with wide experience in the Arctic have stressed the importance of a study to develop more suitable clothing, including footwear, for people living in the Territory. Some information has been recorded from observations on the use of certain kinds of clothing for civilian wear in Alaska, and studies have been made on clothing for military use in the Arctic, all of which may be helpful in initiating this study. Careful research on this subject would no doubt be of real value and might add much to the health and comfort of the people. These studies should not be limited to low-temperature conditions alone, but should cover various kinds of weather encountered in the Territory.

### **ARCTIC HEALTH INSTITUTE**

The investigations and research recommended in this report involve problems that require personnel and physical facilities to carry on the work. Part of the work must be done in the field where the problem exists, while other activities may be undertaken at a convenient central point where permanent research facilities are available. In either case, a headquarters or base institution is necessary for the direction and coordination of the research projects, to make available facilities such as a library and laboratories, where the actual work may be done, and to provide a place where information on Arctic health can be brought together. Such an institution for investigation and research on Arctic health problems does not exist at this time, but would be of great value in carrying forward the research program recommended in this report.

The Public Health Service and the Department of the Interior have recommended strongly that such an Arctic health research institute be built at the University of Alaska. The geographical location at this University is satisfactory for many reasons, including the fact that it is located in an area of low temperatures.

Funds have already been appropriated for a Geophysical Institute to be built at the University of Alaska. Research is already in progress on geophysical problems.

The President of the University and the Board of Regents are interested in the Arctic Health Research Institute. The Board of Regents has offered an attractive site for the institute, which is on a hillside adjacent to the Geophysical Institute and overlooks the valley of the Tanana River.





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